1997 – A Year in Review, Joint Non Lethal Weapons Program

I. INTRODUCTION–WHY NON-LETHAL WEAPONS?

The Changing Threat

Since 1990, the role of U.S. military forces in military operations other than war (MOOTW) and military operations in urban terrain (MOUT) has increased dramatically. These nontraditional military operations (Bangladesh, Haiti, Somalia, Bosnia) demand greater flexibility because they commonly involve close and continual interaction between U. S. forces and noncombatant civilians. Operational use of non-lethal weapons (NLW) is driven by the increasing urbanization of warfare and recognition of the potential for massive collateral damage (unintended civilian casualties and property damage) caused by modern weapons of war. When fighting occurs in urban terrain, adversaries have a much greater opportunity to blend with the civilian population and/or hostages for protection from counterattack. In a rural environment, non-lethal weapons may help reduce noncombatant casualties, because of their inherent reversible effects on personnel and limited destructive effects on material property and the environment. Changes in the nature and perception of warfare and the increasing involvement in MOOTW and MOUT are increasing the need for a non-lethal weapons capability in the U.S. military. As noted in the December
1997 Report of the National Defense Panel entitled "Transforming Defense: National Security in the 21st Century":

"A particularly challenging aspect of the future security environment will be the increasing likelihood of military operations in cities. Currently our capability to conduct MOUT is constrained. In addition, the evolving military challenge will be dealing with adversaries that seek to exploit asymmetric means to overcome our forces and our will."

The Changing Political-Military Environment

Several trends are increasing the need for a non-lethal weapons capability in the U.S. military. The driving forces in general are the changes in the nature and perception of warfare and the increasing involvement in MOOTW and MOUT. Today, U.S. forces are being deployed with roughly the same kinds of tactics, training, and equipment that have been in use for decades. While these capabilities are formidable in combat operations, they do not necessarily provide the flexibility and discretion needed by commanders in today's spectrum of conflict.

Several other factors, beyond the nature of the assigned missions, also drive the need for NLW. In general, there is public concern about the violent nature of modern warfare and about long, lethal, and costly campaigns where vital interests of the nation may not be clearly defined. In addition, operations are reported by the news media who can disseminate video observations, globally, in real time, creating an unprecedented level of scrutiny. Finally, any conflict has associated political

objectives and the accomplishment of those objectives is often enhanced by minimizing non-combat casualties and collateral damage. The peaceful use of military force is a more appropriate and elegant use of military capability in many instances.

The Program Objective

The Joint Non-Lethal Weapons Program has had a brief, but exciting history as a DoD initiative. The program first existed as many separate programs under different sponsors. It began to come together under the leadership and guidance of the Office of the Secretary of Defense (OSD) through DoD Directive 3000.3 which designates the Commandant of the Marine Corps as the Executive Agent for the Joint Non-Lethal Weapons Program.

The objective of the NLW Program is to establish a joint program built upon the Concepts-Based Requirements System (CBRS) and managed according to the joint service Memorandum of Agreement (MOA). The purpose of the NLW Program is to provide the most current and accurate information available on relative aspects of non-lethal technologies to the joint services and other government activities requiring the use of measured response in the performance of their mission. In addition, the program is to provide the Joint Chiefs of Staff and other responsible agencies with recommendations regarding the application of non-lethal technologies on a global basis from a comprehensive perspective, including research, development, tactics, training, and deployment of those technologies. DoD Directive 3000.3 defines NLW as:
Weapons that are explicitly designed to and primarily employed so as to incapacitate personnel and material, while minimizing fatalities, permanent injury to personnel, and undesired damage to property and the environment. Unlike conventional lethal weapons that destroy their targets principally through blast, penetration, and fragmentation, non-lethal weapons employ means other than gross physical destruction to prevent the target from functioning. Non-lethal weapons are intended to have one or both of the following characteristics. They have relatively reversible effects on personnel or material. They affect objects differently within their area of influence.

The Program Structure

The Joint Non-Lethal Weapons (NLW) Program was instituted in January 1997 when the joint service Memorandum of Agreement was signed. The purpose of the Joint MOA is to implement procedures in Public Law 104-106, Section 219 - Non-Lethal Weapons Study. The law states “... the Secretary of Defense shall assign centralized responsibility for development (and any other functional responsibility the Secretary considers appropriate) of non-lethal weapons technology to an existing office within the Office of the Secretary of Defense or to a military service as the

executive agent." Additionally, the agreement implements the Under Secretary of Defense (Acquisition and Technology) (USD (A&T)) direction to the Commandant of the Marine Corps to serve as the NLW Program Executive Agent. The Executive Agent is responsible for program recommendations and for stimulating and coordinating NLW requirements.
The objective of the agreement is to develop and recommend, to the USD (A&T), a fully integrated and coordinated NLW program, to include as appropriate classified NLW programs within the Department of Defense (DoD), that meet the intent of Congress and provide the best NLW technologies and equipment to support our operating forces.

Figure 1 shows the organization structure that is used for execution of the Joint NLW Program. Key elements of this structure include a Joint NLW Integrated Product Team (IPT), Joint Concept and Requirements Group (JCRG), Joint Acquisition Group (JAG), and Joint NLW Directorate (JNLWD). The following sections define the organization and responsibilities of each major entity of the Joint NLW Program.

Executive Agent (EA). The principal role of the EA is to serve as the primary DoD point of contact for NLW. He coordinates NLW requirements of the CINCs, has oversight and ensures coordination between acquisition and requirements communities, and expands operational NLW demonstrations within appropriate ACTDs. He develops and maintains an EA organization, ensures an operational focus for NLW development, and ensures coordination of service testing and evaluation. He also organizes the IPT so as to coordinate the services' acquisition and requirements efforts, recommends appropriate funding levels based on requirements for DoD NLW programs, and approves the consolidated DoD NLW Research, Development, Testing and Evaluation (RDT&E) budget submission (POM).

Integrated Product Team (IPT). To accomplish the DoD Executive Agent responsibilities for the Commandant of the Marine Corps, the Marine Corps Deputy Chief of Staff for Plans, Policies and Operations (DC/S PP&O) chairs the IPT to advise the EA on all joint NLW activities. The Army Deputy Chief of Staff for Operations and Plans (DAMO-ZA) or his designated representative serves as vice-chair. The IPT recommends approval of the consolidated DoD NLW RDT&E POM. It provides oversight to and reviews recommendations of the JCRG and the JAG. It reviews/resolves security, environmental, health and safety, and policy issues that may arise in the development of NLW programs and is the final arbiter for service concerns. Membership on the IPT includes the Chairs of both the JCRG and the JAG, service operations and acquisition representatives, and representatives from OSD, the Joint Staff, and CINCs. The Departments of Energy, Transportation, and Justice are also invited to send observers to the IPT.

Joint Concepts and Requirements Group (JCRG). The Marine Corps Deputy Commanding General, Marine Corps Combat Development Center chairs the

JCRG. The JCRG evaluates service NLW mission needs statements (MNSs) and operational requirements documents (ORDs) and recommends multi-service or joint programs as appropriate. It develops and prioritizes the DoD requirements list in support of POM development. The JCRG provides input to the NLW Master Plan, coordinates and integrates joint material requirements, reviews NLW training initiatives, and participates in doctrine development. The JCRG coordinates and integrates the development of joint NLW models, simulations and war games and incorporates initiatives into joint service efforts.

Joint Acquisition Group (JAG). The Commander, Marine Corps Systems Command chairs the JAG which coordinates and integrates the NLW program concepts and requirements into a management system to achieve standardization and interoperability and optimize resources. The JAG reviews service NLW programs, recommends approval of new starts or termination of unsuccessful or unrewarding program efforts, and coordinates with the JCRG to assist in determining a responsible service. The principal role of the JAG is to harmonize the design, development, test, evaluation, and introduction into service of non-lethal systems.

Joint NLW Directorate (JNLWD). Serving the IPT, JCRG, and JAG, is the Joint NLW Directorate, which functions as the Executive Agent's action office for the day-to-day activities of the NLW program. Responsibilities include serving as the DoD NLW focal point, meeting coordination (IPT, JCRG, JAG, working groups), overall program coordination, liaison with the services, Joint Staff, ACTD program managers, other government agencies, industry, and foreign entities, and sustaining program corporate memory. The structure of the NLW Directorate is shown in Figure 2.

II. 1997–A YEAR IN REVIEW

The Joint Concept

To provide direction and focus for the joint NLW program, the services and U.S. Special Operations Command (USSOCOM) with input from the geographic CINCs, developed a "Joint Concept for NLW." This document identifies the core capability requirements for NLW and the guiding principles that will be used in their development and fielding.

The guiding principles discussed in the Joint Concept are intended to ensure common direction, focused effort, and efficient use of resources in the development of U.S. non-lethal capabilities. These principles apply to many aspects of non-lethal weapons, including desired weapons characteristics and policies for their employment. As guidelines, they are not exclusive. Neither are they designed to create restrictions on the rights and responsibilities of U.S. forces regarding self-defense. Rather, they are key considerations in the future development of non-lethal weapons requirements and capabilities in the areas of equipment, doctrine, organization, training, leader development, and support.

The exploitation of advanced technologies with potential non-lethal weapons applicability calls for innovative, unconventional thinking. The DoD non-lethal weapons approach must encourage the pursuit of nontraditional concepts. Experimentation and developmental approaches must be bound only by the limits of physical possibility. Electronic, acoustic, and non-technological approaches, among others, offer high payoff avenues of investigation and application.

A net improvement in readiness and performance is the goal of creating new capabilities. Non-lethal weapons must not create undue burdens either financially or operationally. Rather, they should enhance the warfighter's and the commander's ability to accomplish assigned missions (Figure 3). This theme—to enhance warfighter operations—is central to every decision involving the development, evaluation, procurement, deployment, and employment of non-lethal weapons. It is the core of the entire set of guiding principles.

In all cases, non-lethal weapons must be complementary to current and planned conventional weapon systems. In seeking to enhance operations, the Joint Non-Lethal Weapons Program will ensure a positive impact upon readiness and also be compatible with our national military objectives, whether political or military.

It is imperative to provide troops with a full range of non-lethal and lethal options and to broaden the set of available responses. The strategy is to rapidly develop and field weapons, munitions, and systems that will enhance the accomplishment of varied military operations in a highly constrained fiscal and very challenging operational environment.

NLW Core Capability Requirements

There are six functional areas established by the Joint Concept for NLW within the categories of counterpersonnel and countermaterial. This taxonomy has evolved to become the two categories and six functional areas as outlined here.

Counterpersonnel. Non-lethal counterpersonnel capabilities enable the application of measured military force with reduced risk of fatalities or serious casualties among non-combatants, friendly, or enemy forces. There are four non-lethal counterpersonnel functional areas to be considered: crowd control, incapacitation of personnel, area denial to personnel, and clearing facilities of personnel.

- Crowd Control provides a non-lethal means of influencing the behavior and activities of a potentially hostile crowd, as well as the capability to bring a mob engaged in a riot under control.

- Incapacitation of Personnel provides non-lethal capabilities to incapacitate personnel, individually or in groups. "Incapacitation" is achieved when weapons' effects result in the physical inability (real or perceived) or mental disinclination to act in a hostile or threatening manner. NLW incapacitation should be readily reversible; preferably self-reversing through the passage of time.

- Area Denial to Personnel can include the use of physical barriers, or systems which produce physical or mental discomfort, or potentially incapacitation, to those who enter.

- Clearing Facilities of Personnel provides the non-lethal capability to clear facilities and structures of personnel, making it temporarily uninhabitable or otherwise not desirable for human presence. NLW capabilities developed in support of crowd control will partially support this functional area.

Countermaterial. Non-lethal countermaterial capabilities render equipment and facilities unusable without complete asset destruction. An implied requirement of countermaterial NLW is to accomplish such a mission without lethal effect on crew members or other personnel in the area.

- Area Denial to Vehicles includes non-lethal capabilities in the form of barriers or systems which artificially reduce the terrain's ability to support traffic of wheeled, tracked, surface effect, and grounded aircraft. This capability also denies ships and other maritime vessels entry or access to specific areas.

- Disabling Vehicles, Vessels, and Facilities provides a non-lethal capability to disable and/or neutralize vehicles, aircraft, vessels, and facilities. This capability would disable ships and other maritime vessels in support of maritime interdiction and to facilitate boarding. This same capability would apply to hardened or protected facilities which need to be neutralized or occupied.

The Funded Programs

Technologies with potential for generating non-lethal military capabilities cover a very broad spectrum. At the "low" end of this spectrum are capabilities which have been in use for many years with varying degrees of success. These include riot batons, pepper spray, and rubber bullets. Their advantage is simplicity. Their disadvantages are lack of "standoff" capability and applicability only to limited scenarios such as hand-to-hand confrontations and riot control. At the "high" end are the currently funded technology programs that will result in the development and fielding of NLW that will more aggressively address the requirements in each of the six functional areas.

In FY97, the Joint NLW Program funded multi-service technology efforts that were chosen in order to fill some of the critical gaps in the service's NLW capabilities. Although these programs don't meet all NLW requirements, they do meet the joint operational requirements developed during joint user group working sessions. The development status of the service programs is a mixture of concept exploration (CE), product definition/risk reduction (PD/RR), and engineering and manufacturing development (EMD).

Modular Crowd Control Munition (MCCM)

The Modular Crowd Control Munition is a non-lethal variant of the claymore mine. The explosive payload is replaced with numerous rubber ball blunt impact munitions. The MCCM will be either ground employed and/or mounted on a vehicle to be used by military forces to apply the minimum force necessary while performing missions of crowd control and site security of key facilities throughout the world. The MCCM must produce enough force upon impact to the torso and/or lower body or extremities of a targeted individual and/or individuals not wearing a protective vest to stop, confuse, disorient and/or momentarily incapacitate.

Accomplishments in FY97:

- Initiated a concept exploration program which included preparation of the initial program documentation, Milestone I/II In Progress Review (IPR), design of prototype test hardware and initial testing.

Objectives for FY98:
- Complete design of the item based on the results of the prototype tests.
- Fabricate and conduct testing on hardware to support the Technical Test/Operational Test.
- Design, fabricate and test a mounting and vehicle protective bracket allowing for placement of the munitions onto the HMMWV and cargo trucks.
- Initiate EMD type classification and prepare documentation to support MS III IPR.

Portable Vehicle Immobilization System (PVIS)

The PVIS is a pre-emplaced system capable of stopping a vehicle (up to 5100 pounds) traveling at speeds between 40-60 miles per hour within 200 feet without serious injury to the vehicle occupants. The PVIS will provide security forces the capability of area denial and enforcement of roadblock operations and improve local area security and protection of individuals and units with quick set-up, high reliability, and operator selected configurations.

Accomplishments in FY97:
- Conducted a successful concept demonstration.
- Army's Program Manager for Mines, Countermines, and Demolitions approved moving the program directly to EMD.

Objectives for FY98:
- Prepare for the design and fabrication of hardware to support EMD testing.
- Design and fabricate hardware, perform validation testing, and prepare technical drawing package and reports.

40 mm Non-Lethal Crowd Dispersal Munition

The 40mm Non-Lethal Crowd Dispersal Munition program will field a non-lethal round of munitions for the M203 40mm Grenade Launcher for crowd control and vehicle protection. This munition will provide the soldier with a means to strike a targeted individual with a direct fire, low hazard, and non-shrapnel producing blunt trauma round from 10-30 meters. A three year EMD phase with the Army's Program Manager for Small Arms is currently underway.

Accomplishments in FY97:
- FY98 new start.

Objectives for FY98:
- Develop performance specifications in conjunction with the Joint ORD and prepare for conducting validation testing of Technical Test/Operational Test (TT/OT) hardware in FY99.

Non-Lethal Bounding Munition

The NL Bounding Munition program will field a non-lethal munition for site security and perimeter defense that functions similar to a tactical bounding Anti-Personnel (APERS) mine, but with a non-lethal payload. Potential payloads include stingballs, malodorants, irritants, and nets. The bounding net munition will deploy a pop-up 50 foot diameter net over the heads of intruders to entangle them and prevent access.

Accomplishments in FY97:
- Developed prototype and demonstrated proof-of-principal of a NL bounding net munition concept as the first payload of the modular bounding munition, leading to a Milestone I decision.

Objectives for FY98:
- Demonstrate net deployment from an APERS mine configuration.
- Develop sensor package and demonstrate it with net deployment system.
- Investigate alternate payloads and demonstrate for integration into APERS mine configuration.
- Prepare for the design and fabrication of hardware to support Demonstration/Validation testing.

Canister Launched Area-Denial System (CLADS)

The Canister Launched Area-Denial System program will field a system that creates a rapidly deployed barrier/deterrent fired from the Volcano Mine Dispenser at standoff distances. It will rapidly deploy NL area denial munitions against both personnel and vehicles. The program will initially demonstrate a HMMWV-mounted, Volcano-dispensed, rapidly erected barrier (2-4 meters in diameter and 5-10

meters in length) of concertina-type wire. An emplacement of a family of non-lethal barriers in less than 10 minutes from standoff distances is envisioned.

Accomplishments in FY97:
- Initiated prototype development of the Canister Launched Area-Denial Wire System (CLAWS) subsystem as the first non-lethal payload for the CLAD system.

Objectives for FY98:
- Complete the demonstration and support the transfer of the program to the Army Program Manager for Mines, Countermines, and Demolitions for initiation of a PD/RR program.
- Prepare for hardware design and fabrication to support PD/RR of the CLADS system with the CLAWS payload. Redefine system design for EMD based on these test results.

UAV NL Payload/Delivery System

The UAV NL Payload/Delivery System program will develop a capability to dispense non-lethal payloads from existing tactical UAVs. Field demonstrations will use the prototype system to determine its ability to successfully deploy non-lethal irritants using long range delivery means. The effort includes the development and fielding of a modular dispensing system for use on a variety of UAV platforms and type classification of a family of non-lethal munitions. The anticipated payloads include tear gas, malodorants, electronic sound devices, stingballs and caltrops. The system is currently in the concept exploration phase at the Naval Surface Warfare Center (NSWC), Dahlgren, VA.

Accomplishments in FY97:
- Conducted a joint mini-conference on NLW Payload Delivery System to obtain user input on tactical objectives for NLW and identify feasible UAV NLW payloads that could respond to these objectives.
- Downselected to the Hunter UAV (as a testbed vehicle) and the Dragon Drone platform being developed in the Marine Corps Warfighting Lab for use in NL payload delivery demonstrations; prioritized payloads for dispensing include: tear gas, malodorants, electric sound devices, stingballs and caltrops.

Objectives for FY98
- Integrate and demonstrate payload capability on board Pioneer and Dragon Drone.
- Develop two new prototype payloads (electronic noise and malodorant).

Under Barrel Tactical Delivery System (UBTDS)
The UBTDS program will field a system that can be mounted under the barrel of the existing M16A2. The system will provide a multi-shot, rapid fire non-lethal direct-fire capability from ranges of 20 to 100 meters. The program is an Advanced Concept

and Technology II (ACT II) effort executed by TACOM-ARDEC and is undergoing evaluation at the Army's Dismounted Battlespace Battle Lab. After the ACT effort concludes, the program will transition to the Army's Program Manager for Small Arms for a three year EMD phase.

Accomplishments in FY97:

- Incorporated design configuration enhancements into the UBTDS to address human factors and operability concerns based on results of a Dismounted Battlespace Battle Lab Warfighting Experiment (BLWE) using ten initial prototypes.

Objectives for FY98:

- Conduct advanced configuration and interface of the UBTDS to a family of weapons to include quick-attachment kits for the M16A2, M4 and Mod Weapon System, magazine adapters, rapidly loadable magazines, and composite materials for reduced weight.
- Conduct additional user evaluations of refined design including evaluation of multiple tactical payload configuration (impact only, liquid filled, powder filled).
- Perform target impact firing evaluations and analysis as a function of velocity, range, accuracy, and munition type.

66mm Vehicle Launched Munitions

The 66mm Vehicle Launched Munitions effort will develop and field a crowd control capability that soldiers can use at standoff distances from the existing vehicle-mounted 66mm smoke dispensing systems also known as Light Vehicle Obscurant Smoke System (LVOSS). Currently, a concept exploration program is incorporating two riot control grenade alternatives (a "stingball" round and a "flash-bang" distraction round) into the design of the existing 66mm smoke grenade. The stingball grenades will eject rubber pellets while the distraction devices will create an audible distraction along with a visible flash. Once fielded, the system will provide short range, indirect-fire munition(s) that can apply the minimum force necessary for crowd control as well as site security missions.

Accomplishments in FY97:

- Identified stingball grenades and distraction devices as the priority rounds for study.
- Initiated static testing.

Objectives for FY98:

- Develop and demonstrate stingball and distraction technology prototypes.
- Conduct static and dynamic testing leading to a concept demonstration for the users and a Milestone I decision.
- Downselect to one technology (stingball vs. distraction device) and develop advanced prototypes for engineering design testing.

Foams Applications

The Foam Applications program will field a new dispensing system (hand-held or shoulder-slung) and rigid foam material (with strong adhesive and cohesive properties) that can be used in a variety of applications such as area denial, sealing of building entrances, and countermaterial applications. This system will deny access to facilities to riotous personnel in a MOUT environment and provide an ability to deactivate counterpersonnel mines or disable weapons. Although a quantitative demonstration of the effectiveness of some rigid foam materials has been shown, there is still a requirement for additional research to develop a quick curing strong bonding material against a variety of surface materials. As this program proceeds through development, it may investigate other foam applications as well as slippery agents. This program is currently in the concept exploration phase at Edgewood Research, Development, and
Engineering Center, Edgewood, MD.

Accomplishments in FY97:
- Conducted a joint service foam workshop.
- Conducted a qualitative demonstration of the effectiveness of some rigid foam materials.

Objectives for FY98:
- Obtain operational feedback on the type of dispenser and properties of the materials.
- Perform countermaterial tests with the foam adhesive materials and begin exploration in designing a foam grenade.

Ground (Electric) Vehicle Stopper

The Ground Vehicle Stopper program will develop and field a new device that will deliver electromagnetic radiation at high-power levels from a ground-based or aircraft mounted microwave source. Military personnel will use the system to selectively stop moving vehicles without causing permanent damage or injury to personnel. The system will immobilize vehicles by burning out the vehicle's electronic engine controls. The system is currently in the concept exploration phase at the Army Research Laboratory (ARL), Adelphi, MD.

Accomplishments in FY97:
- Initiated the development of methods for using electrical discharge and electromagnetic energy to disable ground vehicles without serious injury to the occupants.

Objectives for FY98:
- Determine the susceptibilities of selected vehicles to electric vehicle stopper techniques via analysis and laboratory experiments.

- Conduct static experiments in the laboratory to determine specific parameters that cause upset or damage in military vehicles' electronic engine controls (EEC) using radio frequency (RF) sources.
- Design and build a pre-prototype brassboard system to produce the necessary parameters to stop vehicles tested.

Maritime Vessel Stopper

The Maritime Vessel Stopper program will develop and field a new device that will disable surface vessels at sea without seriously injuring the occupants. In any littoral environment, these craft can expose U.S. and allied forces to potential threats by individuals aboard these pleasure craft as they approach. The Maritime Vessel Stopper effort will provide friendly forces with a non-lethal method of ascertaining the intentions of a suspect vessel and alleviating conflicts within ROEs or political constraints. The system is currently in the concept exploration phase at the Naval Surface Warfare Center, Dahlgren, VA.

Accomplishments in FY97:
- Initiated the development of methods for using non-lethal technologies to disable small surface vessels containing inboard diesel engines.
- Polled the operational community to prioritize the target set (e.g. communication/navigation system, electrical control systems, engine/propulsion systems).

Objectives for FY98:
- Use a systematic approach to identify the most vulnerable components of the prioritized target(s).
- Match appropriate non-lethal technologies against target vulnerabilities taking delivery method and effect desired into account.
- Conduct downselection and prototype development based on laboratory testing of NL technologies.

Acoustic Program

The Acoustics Program will develop acoustic source generators with the frequencies, repetition rates, and waveforms necessary to conduct the accompanying biological effects study, and demonstrate biological effects at user-specified ranges during technology demonstrations. The U.S. Army TACOM-Armament, Research, Development and Engineering Center, in conjunction with Armstrong Laboratories and the U.S. Air Force Research Laboratory is conducting the acoustics target effects study. Identification of a target effect is the critical step needed for future acoustic weapons development.

Accomplishments in FY97:

- Initiated acoustic experiments at U.S. Armaments Research, Development, and Engineering Center (ARDEC) on propagation, beat, and beam forming.
- Characterized contractor devices developed under Army Small Business Innovation Research (SBIR) and Advanced Concepts and Technology II (ACTII) programs.
- Developed initial process for mapping acoustical propagation and intensity levels within structures, including storage bunkers and MOUT buildings.
- Demonstrated a repeatable biological effect using non-aural acoustic energy in a laboratory setting.
- Achieved resonance at several frequencies in surrogate body organs when exposed to acoustic wave energy.

Objectives for FY98:

- Design breadboard of an acoustic weapon for a proof-of-principle demonstration.
- Build, characterize, and transition to the target effects study an impulsive generation device capable of achieving a biological effect.
- Continue MOUT building (bunker) mapping of multiple discrete frequencies and through-wall acoustic power investigative analysis for determining bio-effectiveness feasibility in closed-in structures.
- Confirm the non-aural acoustic energy biological effect.
- Start determination of the physiological cause of the non-aural biological effect.
- Determine the biological effect of applying various waveforms, both impulsive and modulated acoustic energy, to biological surrogates.

Vortex Ring Gun

The Vortex Ring Gun (VRG) program will design, build, and successfully demonstrate the capability to produce combustion-driven, ring vortices that will deter and disorient hostile individuals or crowds. This effort includes integration of concussion, flash, chemical, and impulse methods into a single delivery system capable of being focused onto a specific individual. The gas could be air, CO2, or a knockout or crowd control compound. Applications could include an ability to mark an individual or object with a fluorescing dye at a distance; delivery of an incapacitating agent at a distance; delivery of aerosol at a distance (a chemical to corrode, lock, or otherwise disable an automobile); or temporarily introducing a smoke screen or obscuring agent. The Vortex Ring Gun is currently in the concept exploration phase at the Army Research Laboratory, Adelphi, MD.

Accomplishments in FY97:

- Prepared for generating and characterizing vortices in the laboratory and in the field.
- Designed and fabricated blank cartridge rounds.
- Initiated development of computer design models.

Objectives for FY98:

- Perform parametric studies on the propellant to correlate pressure-time signatures in the breech to the type, weight, and shape of propellant in the 40mm blank cartridge.
- Perform parametric studies on the muzzle adapter nozzle attached to the Mk19 to determine critical geometry for optimal vortex generation and maximum impact down-range.
- Conduct single-shot firing mode evaluations to verify design performance.
- Evaluate 40mm blank cartridge design configurations to ensure automatic-fire.
- Initiate potential chemical entrainment, initially of malodorous substances (e.g. butyl mercapton).
- Conclude FY98 effort with a proof-of-principle firing demonstration.

III. OTHER NLW ACTIVITIES

The Technology Investment Program (TIP)

For FY98 and beyond, a technology investment program has been established within the Joint NLW program. Technology investment is intended to stimulate government laboratories, industry, and academia in generating new technology solutions to meet current or future non-lethal mission needs and requirements.
A “Call for Papers” was issued by the NLW Directorate May 30, 1997, announcing that the NLW program was soliciting proposals. The basis and scope of the call was made from recommendations made during JCRG and JAG working group sessions.

Submissions were evaluated by a Technical Review Panel consisting of representatives from the JCRG and JAG working groups, JNLW Directorate, and other personnel with particular technical expertise, as agreed to by joint concurrence. This panel reviewed the submissions for compliance with the NLW program charter and for their applicability/relevance to the Joint NLW vision as represented in the Joint NLW Master Plan. Submissions were prioritized using criteria such as applicability to non-lethal mission needs and requirements, deliverables, return on investment, jointness, etc. Figure 4 illustrates the TIP Process.

Of the 63 TIP proposals that were received in FY97, the following three were approved for initiation in FY98.

Odorous Substances

The Odorous Substances project will develop a comprehensive matrix of distinctive odors related to specific populations, religious beliefs, and/or geographic areas.

Some odors would be repulsive to the local populace, while others would perhaps be attractive or merely indicate something significant, such as a leak of flammable material. Next, this project will look into locating a chemical compound or mixture of chemicals that duplicates the most important of those odors as nearly as possible. Finally, development of encapsulation methods and a prototype hand-held delivery system for the delivery of those chemicals during various scenarios will be pursued.

Spider Fiber Entangler

The Spider Fiber Entangler project will investigate the feasibility of a new high strength, stretchable fiber for non-lethal applications. The unique combination of strength and stretch of the new fiber can increase the effectiveness of the entanglement with the added benefit of decreased size and weight. This material would appear to be quite effective as an entangler of rudders, propellers, steering mechanisms, fan blades, etc.. Delivery mechanisms for this material will also be investigated.

Non-Lethal Electromagnetic Pulser

The Non-Lethal Electromagnetic Pulser project will explore technology that will disable vehicle electronics and computer control systems using an intense non-nuclear electromagnetic pulse (EMP) from a portable, battery powered unit. The disabling mechanism is eddy currents generated in the electrical components of the vehicle ignition and control system. The result will be the non-lethal and irreversible destruction of ignition and control system electronics.

The Joint Non-Lethal Weapons Database

The joint service MOA for the DoD Non-Lethal Weapons Program directs the Joint NLW Directorate to maintain a database of current/projected NLW technologies, service assets, mission needs statements, and operational requirements documents. In FY97 version 1.0 of the Joint Non-Lethal Weapons Database (JNLWDB) was developed and is a computer-based source of non-lethal weapons information. The purpose of the database is to provide information to assist in the development and acquisition of NLW and related technologies, and will be periodically updated.

The database contains information on NLW concepts, scenarios, policies, MNSs, ORDs, proposals, programs, and systems, all organized under a main menu. Each proposal, program, and system is related to a NLW technology, which is organized in a hierarchy. It also contains a comprehensive list of personnel related to NLW programs, systems, that relate to the program. In addition to informational records, the database contains hundreds of digitized documents which provide details on the systems, programs, proposals, policies, concepts, etc. that relate to the program. The database supports word searches within records as well as within documents.

The database also contains video clips and digitized pictures of selected NLW systems.

Version 1.0 is available on CD-ROM for authorized personnel. Updates to the database will be produced periodically. The CD-ROM runs on a standard personal computer with a Windows 95 operating system. No special software is required to operate the application.

The NLW Master Plan

The NLW Master Plan will provide the NLW Program with an overarching framework, guidance and focus to assist in moving toward specific program objectives. The plan will be updated on a biennial basis and will include up-to-date information on each of the technologies under development as well as additional information relative to the current state and future direction of the program. One of the key annexes will be the Scenario Playbook which is described below. Additionally, it will include an Experimentation Plan and a Modeling and Simulation (M&S) Plan which will be updated as required, but no less than every two years. This document will also serve as a research, development and acquisition plan for the Program and as such will outline a NLW acquisition strategy.

Scenario Playbook

In order to illuminate specific situations that may be encountered, a “Non-Lethal Weapons Playbook” is being developed which contains a series of “scenarios” or “vignettes” to illustrate a particular operational circumstance and the need for use of non-lethal weapons. It is envisioned that this NLW Playbook will contribute directly to development of operational requirements documents (ORDs).
This playbook constitutes an initial framework for describing the situations of interest for MOOTW, MOUT and other Military operations. The situations contained in the playbook are fairly comprehensive since they have been drawn from after action observations, analysis associated with the QDR, and operational analysis conducted for the Office of the Secretary of Defense. By establishing a common framework for NLW related technologies, the playbook can serve developers, technologists, testers, and program planners by providing a set of situations that can be used as a basis to compare and evaluate the utility of candidate operational needs and technological solutions.
Modeling and Simulation (M&S)

The primary purpose of the NLW program’s modeling and simulation effort is to help assess NLW capabilities required for future operations. Modeling and simulation provides the tools that can be used to identify trends and provide quantitative estimates to determine the optimal mix of lethal and non-lethal weapons, to assure the highest degree of success in a given operational scenario.

M&S efforts of the Joint NLW program are intended to stimulate the M&S community to include non-lethal weapon capabilities in existing modeling & simulation programs. It is the intent of the Joint NLW Directorate to use a four stage approach toward this effort:

- Initial exploration of existing wargaming, focusing on modeling NL incapacitation through improved suppression algorithms.
- Further exploration of existing wargaming models through improved fatigue algorithms.
- Integration of complex human behavior modeling and NLW effects data into existing wargaming models.
- Exploration of general military scenarios to study critical parameters related to the use of NLW in operational exercises.

The modeling and simulation strategy that will be used to support the development of NLW requirements for future operations entails: (1) use of a cost-effective methodology to evaluate NLW in an operational context; (2) identification of promising NL technologies before spending dollars on extensive R&D; and (3) ensuring that models and simulations adopted for NLW operational assessment are comprehensive enough to fully address the complicated application of NLW in many different operational environments.

Joint NLW Community Support

Website

The JNLW Directorate has completed work on a new web site accessible through the Headquarters Marine Corps Home Page. It is a fairly extensive site with the goal of keeping the "community" informed as to the program's progress in a number of critical areas. The web site contains background information on the program to include FTP files of the DoD Directive on Non-Lethal Weapons Policy and joint services Memorandum of Agreement, all of which can be downloaded. There is a schedule for upcoming meetings and copies of the latest newsletter. The address: http://www.hqmc.usmc.mil/nlw/nlw.nsf provides access to the main page and provides links to many additional non-lethal weapons pages and sites.

Newsletter

The JNLWD has created a bi-monthly newsletter, "The NLW Update." The first issue was produced in August 1997. The intent is to keep the "community" as well informed as possible on events within the JNLW program. The newsletter is also accessible through the website.

Other DoD NLW Efforts

In addition to the multi-service programs funded by the Joint NLW Program, the Joint NLW Directorate coordinates with and keeps abreast of service-unique programs as well as those programs on-going with the Department of Justice (DoJ), Department of Energy (DoE) and the Office of the Secretary of Defense (OSD). Current service-unique and other DoD NL related programs are described below.

Army Soldier Enhancement Program. The Army's Soldier Enhancement Program is developing various NLW capabilities including a stun (flash bang) hand grenade, a mid-sized riot control dispenser, a 40mm NL sponge round fired from the M203 grenade launcher, a blunt impact munition from the M-16/M-4 series files, and blunt impact munitions from the 12 gauge shotgun. Many of these items will form the basis of a CONUS-based NLW contingency stock.

Marine Corps NLW Capability Sets. The USMC is procuring and fielding non-lethal weapon capability sets which are intended to provide Marine Expeditionary Units with an initial operational NLW capability. The capability sets include blunt impact munitions for the 12 gauge shotgun and 40 mm M203 grenade launcher, non-lethal stingball and flash bang grenades, caltrops, and personnel protection equipment such as riot face shields.

U.S. Air Force Saber 203 Laser Illuminator. The USAF, in conjunction with the Office of the Secretary of Defense Physical Security Equipment Action Group (PSEAG), is developing a rifle mounted, glare producing dazzling light which will cause disorientation and distraction of personnel in facility protection scenarios.
Navy Operations Other Than War Technology Center. The United States Navy has formed an Operations Other Than War Technology Center at the Naval Surface Warfare Center, Dahlgren Division, to coordinate and assess Navy requirements and potential technology solutions in the operations-other-than-war mission area.

IV. The Funding

(OMMITTED IN THIS DOCUMENT)

V. SUPPORTING EFFORTS

Foreign Exchange

The Joint NLW Directorate is responsible for liaison with foreign governments in the area of non-lethal weapons development. To that end, efforts underway among our friends and allies around the world will be surveyed on a regular basis. Those countries doing work that is similar in scope and focus to the U.S. Program, or that may be exploring other technologies of interest to the U.S., will be considered for some type of bilateral agreement. Work is underway to cooperate with Israel and the UK, as well as several of our other NATO allies. The exchange of technical information is considered to be on a balanced "quid pro quo" basis, and will allow both countries to benefit and leverage each other's research work in this area. This

will prevent the duplication of R&D efforts on an international scale, thereby saving costs for all participants.

Experimentation

The Joint NLW Program is aggressively engaged in experimentation to explore new concepts in technology, as well as in doctrine, training and tactics. This work is currently being done through the Army's Dismounted Battlespace Battle Lab (DBBL), the Marine Corps Warfighting Lab (MCWL), and the Air Force's Force Protection Battle Lab. The labs receive joint funds and develop an annual experimentation schedule consistent with the overall program experimentation plan. Each lab is also responsible for execution of their plan and providing semi-annual reviews to the Directorate. The ultimate goal of this effort is to surface new technologies or operational concepts that can then be transitioned to the appropriate service agency for formal development.

Additional experimentation will be accomplished as part of the Military Operations in Urban Terrain Advanced Concept Technology Demonstration (MOUT ACTD). The Joint NLW Directorate will serve as the sponsor for all non-lethal experimentation in the MOUT ACTD. In that role, the Directorate will assist in planning, coordinating and integrating the services' non-lethal technology experiments into the MOUT ACTD schedule for experimentation up through the capstone exercise in FY00.

Joint Integration Project (JIP)

The JIP effort will be a coordinated project under Marine Corps leadership to ensure that as the services develop their own unique non-lethal capability sets for their operating forces, there is no duplication of effort. A JIP working group will meet regularly to explore common ground on the procurement of like items and munitions, joint safety certification and type classification, and non-lethal capability set-related training. Where appropriate, the services will enter into memoranda of agreement to pursue common fielding objectives.

Human Effects Advisory Panel (HEAP)

As we get closer to actually fielding an enhanced non-lethal capability, there are several questions relative to the "acceptability" principle found in the "Joint Concept for Non-Lethal Weapons." It is important from a programmatic standpoint that determination of system feasibility be made across the full spectrum of acceptability criteria as early as possible in the development cycle of a specific technology. The criteria themselves need to be developed. The exact delineation of dosage, exposure rates, or impact data measured against a certain target population necessary to achieve a specifically quantifiable effect (i.e. non-lethality vs. lethality) must be determined. In this regard, a panel of quasi-independent (non-

governmental) experts from the field of medicine, law enforcement, engineering, law, and science will be established under the auspices of the Institute of Non-Lethal Defense Technologies at the Applied Research Lab, Pennsylvania State University. This academia-based group will assist in assessing the detailed test data provided by government and government-contracted labs against the identified acceptability standards. Programmatic recommendations will be provided to the Executive Agent through the JNLWD to assist in determining the continued direction of future research and development.

Professional Military Academic Support/Interaction

Taking advantage of the extensive resources and expertise available through our professional military command and staff colleges and universities can provide valuable input to the overall NLW Program. Both students and faculties at several institutions have either expressed interest in doing research work in cooperation with the JNLWD, or have, on their own initiative, conducted worthwhile studies in the area of non-lethal weapons. Early participants include:

The Naval Post Graduate School, Monterrey, CA
The Naval War College
The Army War College
The Air Command and Staff College
Uniformed Services University of the Health Sciences

VI. Conclusion

Clearly the program, through the efforts and cooperation of all the services and USSOCOM, has made significant progress over the past year in terms of getting organized and moving technologies forward. There is a great deal of work yet to be done. Project offices and engineers not familiar with working in a joint environment must now reach out to counterparts in different organizations and ensure that the right people are engaged at each step along the way to fielding a new system. The technology itself presents us all with challenges concerning the potential to deliver specifically defined effects on a wide array of “targets”. These challenges can be either obstacles or opportunities for the Program to reach its ultimate objective of providing real capabilities to our Soldiers, Sailors, Airmen, and Marines. The present course we are on will hopefully approach these challenges as opportunities and our joint forces in the field will realize a recognizable improvement in their readiness to operate in increasingly frequent military operations other than war.

This next year the Program and all its participants will continue to evolve the way we do business. Enhanced communications both laterally and vertically within the Joint NLW community can only serve to further our collective interests and objectives. With those thoughts in mind, the broad objectives for the Program over the coming year are:

- Realize an improved capability and readiness within our deployed forces.

- Identify increased participation of supporting services in individual projects.
- Compress fielding timelines on at least 1/3 of all acquisition projects.
- Eliminate any and all duplication of effort in procurement plans.
- Explore new concepts for both technology and employment.
- Raise awareness and education in the operating forces.

These objectives are both realistic and achievable over the next twelve months. Achieving them demands continued cooperation and teamwork by all concerned. Next year's report will address how well the Program did in this regard.